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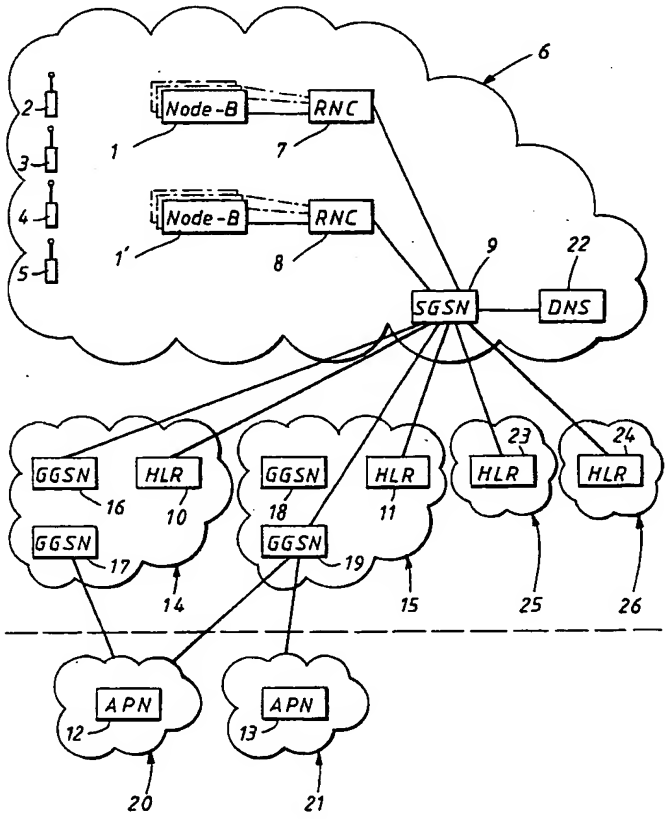
(54) Title: METHOD AND DEVICE FOR A SHARED RADIO NETWORK



(57) Abstract: Method and device, respectively, for determining which one of the owners of a shared radio network (6) that a visiting MT (Mobile Terminal), whic MT (4, 5) is not subscribed to any of the owners of said shared radio network (6), is going to be connected to, by deriving information from the visitin gMT (4, 5) concerning its identity. The method and device, respectively, is characterized in that said information is used in said shared radio network (6) for determining which one of said owners said visiting MT (4, 5) is going to be connected to.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Method and device for a shared radio network

TECHNICAL FIELD

The invention relates to a method and device, respectively, for determining which one of the owners of a shared radio network that a visiting MT (Mobile Terminal), which MT is not subscribed to any of the owners of said shared radio network, is going to be connected to, by deriving information from the visiting MT concerning its identity.

BACKGROUND ART

Due to the development of equipment for wireless transport of data, for example e-mail, many network operators are establishing such services for their customers. Future fields of use may be to acquire video sequences from an on-going sports event, for example a game of football. When a goal is scored one may watch the event on, by way of example, a cell phone monitor.

Previously, so-called circuit coupling has been used for transmission of data. Data is then sent via a line, and the operator charges the user for the time the line is open. Then data is only sent sporadically, and the user pays for the capacity that is reserved for him.

When using GPRS (Global Packet Radio Service), data is sent in packages and the operator then has the possibility to charge the user for the amount of data that is sent. Using this service, the line is either shared with other users, or only open when the packages are transmitted.

Previous GPRS systems are called 2.5G (second and a half generation) and use GSM (Global System for Mobile communication) as radio system. Now

the operators are going to introduce 3G (third generation) where GPRS uses UMTS (Universal Mobile Telecommunications System) as radio system. UMTS is faster then the older GSM, and has the support of many major telecommunications operators and manufacturers because it represents a unique opportunity to create a mass market for highly personalised and user-friendly mobile access to tomorrow's information society. UMTS will deliver pictures, graphics, video communications and other wideband information as well as voice and data, directly to people who can be on the move. UMTS builds on the capability of today's mobile technologies (like digital cellular and cordless) by providing increased capacity, data capability and a far greater range of services using an innovative radio access scheme and an enhanced, evolving core network.

However, the introduction of UMTS is expensive for the operators as licenses have become very expensive for many 3G operators. The equipment is also quite expensive. One way to decrease the cost of the UMTS introduction is for two or more 3G operators to establish a shared 3G radio network. Some network elements are located in the home network of respective operator. Exampless of network elements in the home network are GGSN (Gateway GPRS Support Node) and HLR (Home Location Register). The GGSN is a gateway node that terminates specific protocols, and the HLR is a large data base containing information about all subscribers. The shared network must be able to pass outgoing packet sessions via the correct home network.

A network may be shared by two or more operators, for illustrative reasons we suppose that the shared network is shared by two operators and call them operator A and B. If two mobile terminals, MT1 and MT2, which are subscribed to operator A and operator B, respectively, are going to pass outgoing data packet sessions via the shared network, an SGSN (Swithing GPRS Support Node), a kind of switch, in said shared network is able to pass said outgoing packet sessions via the correct home network of the operators A and B.

If a visiting mobile terminal MT3, which is subscribed to an operator X, is going to pass outgoing data packet sessions via the shared network belonging to operators A and B, said shared network is able to determine that MT3 is a visiting mobile terminal, and that it may use the shared network (operator X has an agreement with either operator A or operator B, or both). The shared network is, however, not able to determine via which home network of the operators A and B the data packages are to be passed. The result is that it is not possible to predict towards which GGSN the visiting MT3 will establish a so-called PDP context (Packet Data Protocol), i.e. a connection for GPRS.

If two mobile terminals MT3 and MT4 are subscribed to operators X and Y, respectively, and are going to pass data packages via a shared network belonging to operators A and B, the SGSN in said shared network may only state that MT3 and MT4 are visiting mobile terminals, and if they are allowed to use the shared network, nothing else.

It would be of interest to route the visiting mobile terminals in a shared network, subscribed to different operators, that not are the ones that own the shared network, to predetermined home networks of the operators that own the shared network depending on which operators the visiting mobile terminals are subscribed to. There is no way for the current available technology to admit the shared network to identify to which operator a visiting mobile terminal is subscribed.

DISCLOSURE OF INVENTION

An object of the invention is to determine which one of the owners of a shared radio network that a visiting MT (Mobile Terminal), which MT is not subscribed to any of the owners of said shared radio network, is going to be

connected to, by deriving information from the visiting MT concerning its identity.

The object is solved by using said information in said shared radio network for determining which one of said shared radio network owners said visiting MT is going to be connected to.

In a preferred embodiment the shared radio network uses GPRS (Global Packet Radio Service).

In another preferred embodiment regarding the radio system used, the shared radio network may use any of the radio systems UMTS (Universal Mobile Telecommunications System), GSM (Global System for Mobile communication), CDMA (Code Division Multiple Access) or TDMA (Time Division Multiple Access).

In yet another preferred embodiment the IMSI (International Mobile Subscriber Identity) of the visiting MT is used for deriving information concerning the identity of said MT and a list in the SGSN (Switching GPRS Support Node) of said shared radio network for comparison with information concerning the identity of the visiting MT.

BRIEF DESCRIPTION OF DRAWINGS

The invention will be described below in connection with an example of a preferred embodiment and the enclosed drawings, where

Figure 1 is a schematic view of a mobile terminal contacting a base station; and

Figure 2 is a schematic overview of a system in which the invention can be applied.

MODE FOR CARRYING OUT THE INVENTION

This invention constitutes an improvement in the field of wireless data networks, in particular wireless package data networks. Due to the development of equipment for wireless transport of data, for example e-mail, many network operators are establishing such services for their customers. Future fields of use may be to acquire video sequences from an on-going sports event, for example a game of football, when a goal is scored, and watch the event on a wireless monitor. With reference to Figure 1, a mobile base station, here referred to as Node-B 1 is contacted by an MT (mobile terminal) 2. When using GPRS (Global Packet Radio Service) data is sent in packages, and the operator then has the possibility to charge the user for the amount of data that is sent. Using this service, the line is either shared with other users, or only open when the packages are transmitted.

The introduction of 3G (third generation) wireless networks means that the service GPRS uses UMTS (Universal Mobile Telecommunications System) as radio system. UMTS is faster then the older GSM, but the introduction of UMTS is expensive for the operators as licenses have become very expensive for many 3G operators. The equipment is also quite expensive. One way to decrease the cost of the UMTS introduction is, by way of example, for two or more 3G operators to establish a shared 3G radio network. Some network elements are located in the home network of respective operator. Example of network elements in the home network is GGSN (Gateway GPRS Support Node) and HLR (Home Location Register). The GGSN is a gateway node that terminates specific protocols, and the HLR is a large data base containing information about all subscribers. The shared network must be able to pass outgoing packet sessions via the correct home network.

With reference now to Figure 2, four MT:s 2, 3, 4, 5 are located in a shared radio network 6. An MT 2 contacts the shared radio network 6 which is

owned by operators of which one operator is the one that the MT 2 is subscribed to. There one Node-B 1 is contacted, said Node-B 1 is connected to an RNC (Radio Network controller) 7. Note that it is schematically shown in Figure 2, but without reference signs, that more than one Node-B may be connected to the RNC 7. There may also be more than one RNC 7, 8 in a shared radio network 6, as shown in Figure 2, where one or more Node-B 1 are connected to an RNC 7 and one or more Node-B 1' are connected to another RNC 8. There can be more than two RNC:s 7, 8 in a shared radio network 6, but Figure 2 only shows two RNC:s 7, 8. The RNC:s 7, 8 in a shared radio network 6 are connected to an SGSN (Switching GPRS Support Node) 9 which works as a kind of switch. The SGSN 9 retrieves an IMSI (International Mobile Subscriber Identity) from MT 2. The IMSI is incorporated in the MT 2, by way of example in the SIM card. Then the SGSN 9 contacts a HLR (Home Location Register) 10, 11, which is a large database containing information about the subscribers and which APN (Access Point Name) 12, 13 that a specific subscriber may use, which information is provided to the SGSN 9 using the IMSI. The APN 12, 13 consists of two parts; an NI (network identity) and an OI (Operator Identity). The HLR 10, 11 used is the one that belongs to a home network 14, 15 of the MT 2. Note that the elements shown in the home network 14, 15 are those that are necessary for the understanding of the invention, and a number of other, not shown, elements may be a part of the home network 14, 15.

The APN 12, 13 may be provided by the MT 2 or the SGSN 9 to select a GGSN (Gateway GPRS Support Node) 16, 17, 18, 19, different GGSN:s are linked to different IP networks 20, 21. When the SGSN 9 has acquired a complete APN 12, 13, as will be described below, a DNS (Domain Name System) 22 is contacted. The DNS 22 delivers the GGSN IP addresses that correspond to a certain APN, i.e. provides information regarding which GGSN:s 16, 17, 18, 19 that supports the APN 12, 13 in question and thus enables the SGSN 9 to switch the MT 2 to the correct GGSN 16, 17, 18, 19, from where contact is established with an IP network 20, 21. The dashed line

in Figure 2 constitutes a border line between GPRS (above) and IP networks (below).

There are three scenarios regarding how the SGSN 9 acquires an APN 12, 13:

Firstly, if the MT 2 does not provide any APN information to the SGSN 9, the SGSN 9 either chooses an NI from the subscription of the MT 2 or chooses a default NI. After that, an OI is added, making the APN 12, 13 complete.

Secondly, if the MT2 provides an NI to the SGSN 9, the NI is verified for the user in question that has been identified previously via the IMSI. After that, if correctly verified, an OI is added thus making the APN 12, 13 complete.

Thirdly, if the MT2 provides both an NI and an OI to the SGSN 9, the NI and OI are verified for the user in question that has been identified previously via the IMSI. If correctly verified, the APN 12, 13 is complete.

As the MT 2 is subscribed to an operator that is one of the owners of the shared network, the IMSI provides information that specifies that the MT 2 is not visiting, and if the SGSN 9 is not provided with a complete APN 12, 13, e.g. if the MT has not provided an NI, the SGSN 9 provides an NI. The SGSN 9 then has accessed information about which operator the MT 2 is subscribed to and which home network the MT 2 shall use. The SGSN 9 then uses the DNS 22 to find out which GGSN:s 16, 17, 18, 19 that may be used, and connects the MT 2 to the correct GGSN 16, 17, 18, 19, establishing a so-called PDP context (Packet Data Protocol), i.e. a connection for GPRS.

If, however, an MT 4 that is subscribed to an operator that is not one of the owners of the shared network 6, the SGSN 9 contacts a HLR 23, 24 of that MT:s home network 25, 26 and uses the IMSI to find out that the MT 4 is a visiting MT. Note that the element shown in the home network 25, 26 is that

which is necessary for the understanding of the invention, and a number of other, not shown, elements may be a part of the home network 25, 26. Said HLR 23, 24 confirms that the MT 4 is allowed to use the shared network, i.e. the operator that the MT 4 is subscribed to has an agreement with one or more of the owners of the shared network. Previously known technology does not disclose with which of the owners of the shared network that the MT 4 operator has an agreement, the visiting OI is not derived, why it is not possible to predict towards which GGSN 16, 17, 18, 19 the MT 4 will establish its PDP context.

According to the invention, the visiting terminal's OI is derived from the IMSI in said terminal. This makes it possible to assign the correct visiting OI for all visiting mobiles. Thus a dynamically assigned visiting OI based on the IMSI is introduced.

We will now describe an example according to the invention with continued reference to Figure 2. Four mobile terminals MT 2, 3, 4, 5 have here contacted an SGSN 9 in a shared network owned by the two operators A and B. Two of the MT:s 2, 3 are subscribed to operator A and operator B, respectively, and are identified via their IMSI:s that provide complete APN:s 12, 13 consisting of NI + OI, i.e. Domain Name + operator A-OI and a Domain Name + operator B-OI, respectively. The HLR:s 10, 11 are contacted and inform the SGSN 9 that the subscribers may use the APN:s 12, 13 that are chosen. The SGSN 9 then uses the DNS 22 to find out which GGSN:s 16, 17, 18, 19 that may be used, and switches the MT:s 2, 3 to the correct GGSN:s, 16, 17, 18, 19, establishing PDP contexts. The MT 2 then establishes a PDP context with an appropriate GGSN 16, 17 in the home network 14 of operator A and the MT 3 then establishes a PDP context with an appropriate GGSN 18, 19 in the home network 15 of operator B. The GGSN:s 16, 17, 18, 19 then establishes contact with desired IP networks 20, 21.

The other two MT:s 4, 5 are subscribed to operator X and operator Y, respectively, and are identified via their IMSI as visiting. Assuming operator X has an agreement with operator A and operator Y has an agreement with operator B, the correct subscriber may now be connected to the correct operator, A or B. By way of example, this is achieved by means of a list in the SGSN 9 that provides a complete APN 12, 13 consisting of NI + OI, i.e. a Domain Name + operator A-OI and a Domain Name + operator B-OI, respectively. The HLR:s 23, 24 are contacted and inform the SGSN 9 that the subscribers may use the APN:s 12, 13 that are chosen. The SGSN 9 then uses the DNS 22 to find out which GGSN:s 16, 17, 18, 19 that may be used, and switches the MT:s 4, 5 to the correct GGSN 16, 17, 18, 19, establishing PDP contexts. The MT 4 then establishes a PDP context with an appropriate GGSN 16, 17, in the home network 14 of operator A and the MT 5 then establishes a PDP context with an appropriate GGSN 18, 19 in the home network 15 of operator B. The GGSN:s 16, 17, 18, 19 then establishes contact with desired IP networks 20, 21.

It is to be noted that the embodiment example described above only is an example of how the invention may be applied. The shared network may be owned by more than two operators, and the agreements with the visiting MT:s 4, 5 may be of a more detailed nature than what has been described in the example above.

The connections shown in Figure 2 shall only be regarded as examples of possible connections, not as limitations in any way.

The invention is not limited to UMTS, but may be used for any other suitable radio system, e.g. GSM, CDMA (Code Division Multiple Access) or TDMA (Time Division Multiple Access).

The invention is not limited to what has been described above, but may be varied freely within the scope of the appended claims.

CLAIMS

1. Method for determining which one of the owners of a shared radio network (6) that a visiting MT (Mobile Terminal) (4, 5), which MT (4, 5) is not subscribed to any of the owners of said shared radio network (6), is going to be connected to, said method comprising:

deriving information from said visiting MT (4, 5) concerning its identity,

characterized in that it comprises:

using said derived information in said shared radio network (6) for determining which one of said shared radio network owners said visiting MT (4, 5) is going to be connected to.

2. Method according to claim 1, characterized in that said shared radio network (6) uses GPRS (Global Packet Radio Service).

3. Method according to claim 1 or 2, characterized in that said shared radio network (6) uses the radio system UMTS (Universal Mobile Telecommunications System).

4. Method according to claim 1 or 2, characterized in that said shared radio network (6) uses the radio system GSM (Global System for Mobile communication).

5. Method according to claim 1 or 2, characterized in that said shared radio network (6) uses any of the radio systems CDMA (Code Division Multiple Access) or TDMA (Time Division Multiple Access).

6. Method according to any one of the claims 1 to 5, characterized in that the method uses the IMSI (International Mobile Subscriber Identity) of the visiting MT (4, 5) for deriving information concerning the identity of said visiting MT (4, 5).

7. Method according to any one of the claims 1 to 6, characterized in that the method uses a list in the SGSN (Switching GPRS Support Node) (9) of said shared radio network (6) for comparison with the derived information concerning the identity of the visiting MT (4, 5).

8. Device for determining which one of the owners of a shared radio network (6) that a visiting MT (Mobile Terminal), which MT (4, 5) is not subscribed to any of the owners of said shared radio network (6), is going to be connected to, by deriving information from said visiting MT (4, 5) concerning its identity, characterized in that said device comprises means for determining which one of said owners said visiting MT (4, 5) is going to be connected to, based on said derived information.

9. Device according to claim 8, characterized in that said shared radio network (6) is adapted for GPRS (Global Packet Radio Service).

10. Device according to claim 8 or 9, characterized in that said shared radio network (6) is adapted for the radio system UMTS (Universal Mobile Telecommunications System).

11. Device according to claim 8 or 9, characterized in that said shared radio network (6) is adapted for the radio system GSM (Global System for Mobile communication).

12. Device according to claim 8 or 9, characterized in that said shared radio network (6) is adapted for any of the radio systems CDMA (Code Division Multiple Access) or TDMA (Time Division Multiple Access).

13. Device according to any one of the claims 8 to 12, characterized in that said device comprises means for deriving information concerning the identity of the visiting MT (4, 5) from the IMSI (International Mobile Subscriber Identity) of said visiting MT (4, 5).

14. Device according to any one of the claims 8 to 13, characterized in that said device comprises means for comparing the derived information concerning the identity of the visiting MT (4, 5) with a list in the SGSN (Switching GPRS Support Node) (9) of said shared radio network (6).

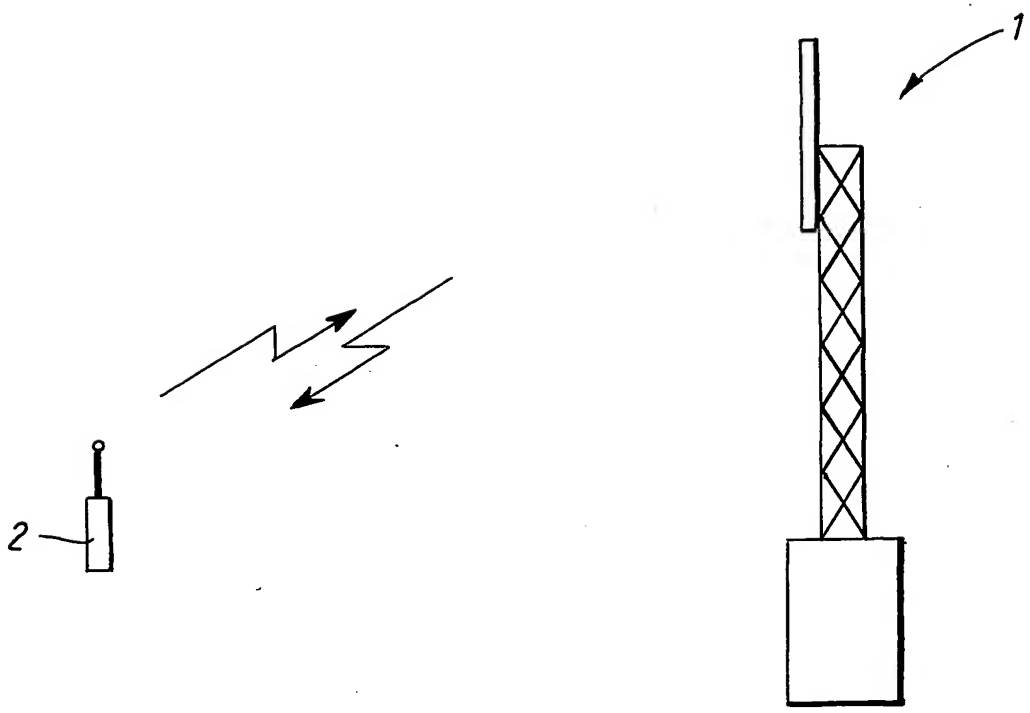
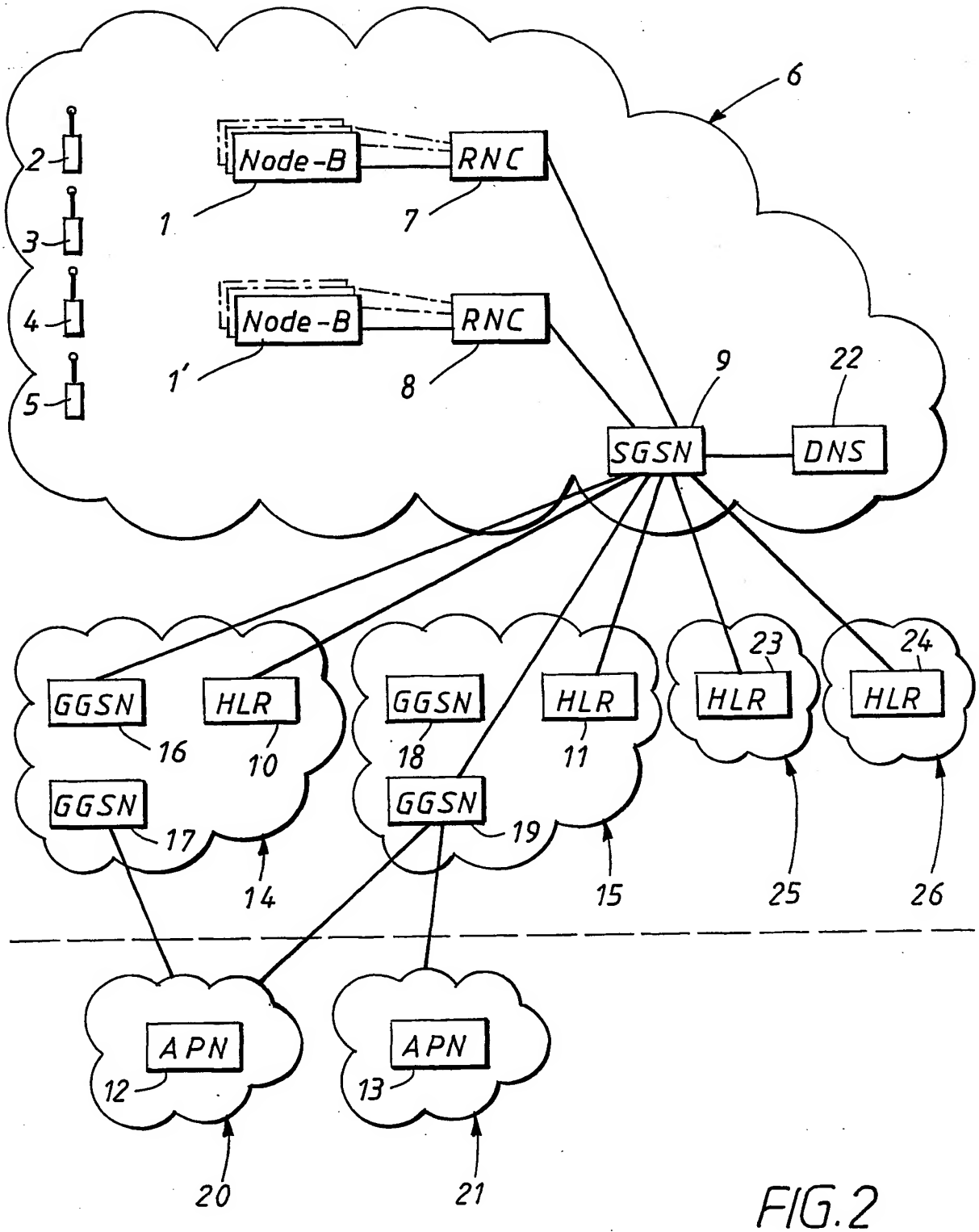


FIG.1


6
2
3
4
5
Node-B
RNC
1
7
Node-B
RNC
1'
8
9
22
SGSN
DNS
GGSN
HLR
16
10
GGSN
17
14
GGSN
HLR
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GGSN
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HLR
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25
HLR
24
26
APN
12
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APN
13
21

FIG.2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/00416

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/38
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6038439 A (RUNE), 14 March 2000 (14.03.00), column 1, line 51 - column 2, line 12 --	1-14
A	WO 9805181 A2 (ERICSSON INC), 5 February 1998 (05.02.98), page 9, line 9 - line 32 --	1-14
A	WO 0158190 A1 (TELIA AB), 9 August 2001 (09.08.01), abstract --	1-14

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"P" document published prior to the international filing date but later than the priority date claimed
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"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 June 2002	17 -06- 2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Ann Börjeson/SN Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE 02/00416

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6038439 A	14/03/00	AU 4143697 A	02/04/98
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